

WHAT IS CLAIMED IS:

1. A tool replacement method of performing a replacement of a tool to a spindle of a machine tool in which the spindle has a chuck provided on a distal end thereof for chucking the tool and a nut screwed to the distal end and rotatable for tightening and loosening the chucking, the method comprising the steps of:

5 positioning the spindle relative to a nut loosening station provided with a nut loosening driver for driving the nut to rotate in a loosening direction of the nut;

 driving the nut by the nut loosening driver to remove from the chuck a first tool to be replaced with a second tool;

10 positioning the spindle relative to a nut tightening station provided with a nut tightening driver for driving the nut to rotate in a tightening direction of the nut; and

 driving the nut by the nut tightening driver to tight-chuck the second tool.

2. A nut driver for a machine tool including a spindle having a chuck provided on a distal end thereof for chucking a tool and a nut screwed to the distal end and rotatable for tightening and loosening the chucking, the nut driver comprising:

15 a nut tightening driver engageable with the nut for driving the nut in a tightening direction of the nut;

 a nut loosening driver engageable with the nut for driving the nut in a loosening direction of the nut; and

20 a station holder configured to be positioned relative to the spindle, and to mount thereon a neighboring combination of the nut tightening driver and the nut loosening driver.

25 3. A nut driver according to claim 2, further comprising:

 a spindle fixer for fixing the spindle when the nut is driven by one of the nut tightening driver and the nut loosening driver.

4. A nut driver according to claim 2, wherein:

30 the nut tightening driver comprises an axially lapping combination of a forward-rotating driver engageable with the nut for driving the nut to rotate in a forward direction, and a first spindle rotation preventer engageable with the spindle for preventing the spindle from rotating in the forward direction; and

35 the nut loosening driver comprises an axially lapping combination of a reverse-rotating driver engageable with the nut for driving the nut to rotate in a reverse direction of the forward direction, and a second spindle rotation preventer engageable with the

spindle for preventing the spindle from rotating in the reverse direction.

5. A nut driver according to claim 4, wherein the combination of the nut tightening driver and the nut loosening driver comprises:

5 a one-directional rotary mechanism holder provided with a one-directional rotary mechanism engageable with the nut for driving the nut to rotate simply in one direction;

10 a first intermediate mount having a first resilient support mechanism for supporting the one-directional rotary mechanism holder substantially in a co-centered condition;

a rotary mount having a second resilient support mechanism for supporting the first intermediate mount substantially in a co-centered condition;

an actuator for actuating the rotary mount to rotate;

15 a rotation preventing mechanism holder provided with a rotation preventing mechanism engageable with the spindle to prevent the spindle from rotating relative to rotation of the nut in the one direction;

a second intermediate mount having a third resilient support mechanism for supporting the rotation preventing mechanism holder substantially in a co-centered condition; and

20 a spindle fixer provided with an non-rotatable stationary mount having a fourth resilient support mechanism for supporting the second intermediate mount substantially in a co-centered condition.

6. A nut driver according to claim 5, wherein:

25 the first resilient support mechanism comprises a pair of first plate springs, with the one-directional rotary mechanism holder in between;

the second resilient support mechanism comprises a pair of second plate springs substantially perpendicular to the pair of first plate springs, with the first intermediate mount in between;

30 the third resilient support mechanism comprises a pair of third plate springs, with the rotation preventing mechanism holder in between; and

the fourth resilient support mechanism comprises a pair of fourth plate springs substantially perpendicular to the pair of third plate springs, with the second intermediate mount in between.